

# SEMICONDUCTOR QUANTUM OPTOELECTRONICS

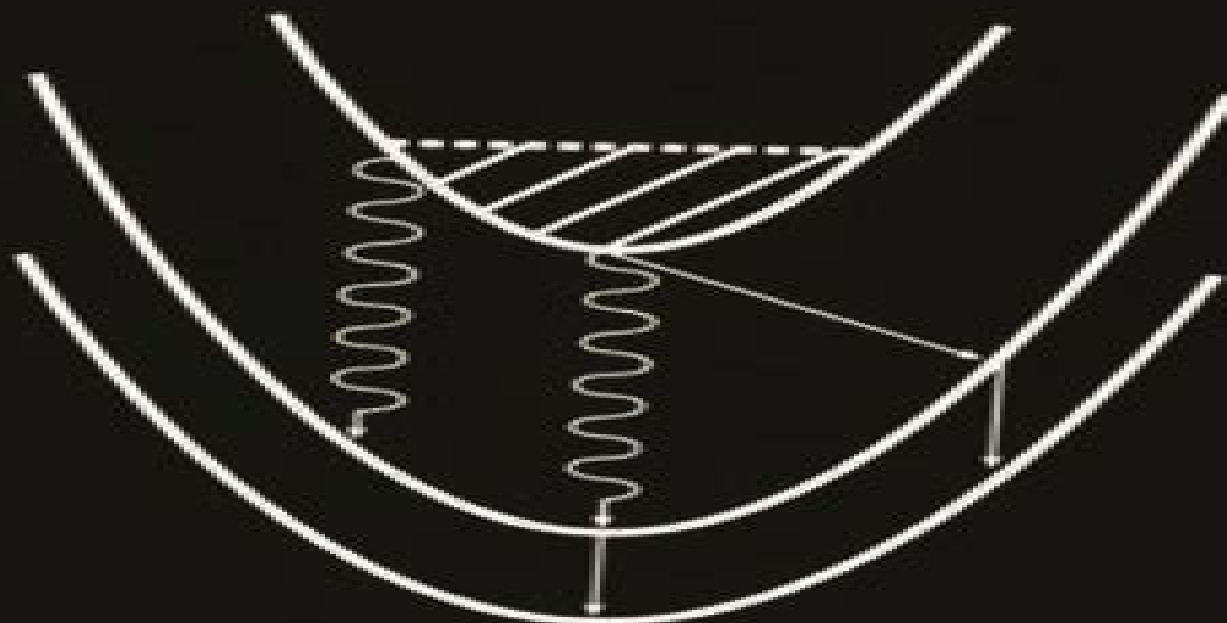
From Quantum Physics to Smart Devices

*edited by*

A. MILLER

- M. EBRAHIMZADEH

D. M. FINLAYSON



Proceedings of the Fiftieth Scottish Universities  
Summer School in Physics, July 1998

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# Semiconductor Quantum Optoelectronics From Quantum Physics To Smart Devices

**Kerry Vahala**



## **Semiconductor Quantum Optoelectronics From Quantum Physics To Smart Devices:**

**Semiconductor Quantum Optoelectronics** A. Miller, 2020-12-18 The development and application of low dimensional semiconductors have been rapid and spectacular during the past decade Ever improving epitaxial growth and device fabrication techniques have allowed access to some remarkable new physics in quantum confined structures while a plethora of new devices has emerged The field of optoelectronics in particular has benefited from these advances both in terms of improved performance and the invention of fundamentally new types of device at a time when the use of optics and lasers in telecommunications broadcasting the Internet signal processing and computing has been rapidly expanding An appreciation of the physics of quantum and dynamic electronic processes in confined structures is key to the understanding of many of the latest devices and their continued development Semiconductor Quantum Optoelectronics covers new physics and the latest device developments in low dimensional semiconductors It allows those who already have some familiarity with semiconductor physics and devices to broaden and expand their knowledge into new and expanding topics in low dimensional semiconductors The book provides pedagogical coverage of selected areas of new and pertinent physics of low dimensional structures and presents some optoelectronic devices presently under development Coverage includes material and band structure issues and the physics of ultrafast nonlinear coherent intersubband and intracavity phenomena The book emphasizes various devices including quantum wells visible quantum cascade and mode locked lasers microcavity LEDs and VCSELs and detectors and logic elements An underlying theme is high speed phenomena and devices for increased system bandwidths

**Semiconductor Quantum Optoelectronics** Alan Miller, M. Ebrahimzadeh, Majid Ebrahimzadeh, D. M. Finlayson, 1999 This book combines new physics and the latest device developments in low dimensional semiconductors The development and application of low dimensional semiconductors has been rapid and spectacular during the past decade Ever improving epitaxial growth and device fabrication techniques have allowed access to some remarkable new physics in quantum confined structures while in parallel a plethora of new devices have emerged The field of optoelectronics in particular has benefited from these advances both in terms of improved performance and the invention of fundamentally new types of device at a time when the use of optics and lasers in telecommunications broadcasting the internet signal processing and computing has been rapidly expanding An appreciation of the physics of quantum and dynamical electronic processes in confined structures is key to the understanding of many of the latest devices and involvement in their continued development This book allows those who already have some familiarity with semiconductor physics and devices to broaden and expand their knowledge into new and expanding topics in low dimensional semic

**High-Power Diode Lasers** Roland Diehl, 2003-07-01 Methods of design and fabrication of high power diode lasers using proven semiconductor technologies are described in this book The latter include epitaxy and optical lithography mounting on heat sinks beam forming with micro optics and coupling to optical fibers and reliability testing Direct applications of high power diode lasers in materials

processing and for pumping hitherto unknown solid state laser systems are presented in a comprehensive fashion Thus this book is an invaluable source of information for all scientists and engineers designing laser systems and applying the laser as a reliable and economic tool in a multitude of environments      Ultrafast Phenomena in Semiconductors Kong-Thon Tsen,2012-12-06 There are many books in the market devoted to the review of certain fields This book is different from those in that authors not only provide reviews of the fields but also present their own important contributions to the fields in a tutorial way As a result researchers who are already in the field of ultrafast dynamics in semicon ductors and its device applications as well as researchers and graduate students just entering the field will benefit from it This book is made up of recent new developments in the field of ultrafast dynamics in semiconductors It consists of nine chapters Chapter 1 reviews a microscopic many body theory which allows one to compute the linear and non linear optical properties of semiconductor superlattices in the presence of homogeneous electric fields Chapter 2 deals with ultrafast intersubband dynamics in quantum wells and device structures Chapter 3 is devoted to Bloch oscillations in semicon ductors and their applications Chapter 4 discusses transient electron transport phenomena such as electron ballistic transport and electron velocity overshoot phenomena as well as non equilibrium phonon dynamics in nanostructure semicon ductors Chapter 5 reviews experimental and theoretical work on the use of the phase properties of one or more ultrashort optical pulses to generate and control electrical currents in semiconductors      **Frequency-Resolved Optical Gating: The Measurement of Ultrashort Laser Pulses** Rick Trebino,2012-12-06 The Frequency Resolved Optical Gating FROG technique has revolutionized our ability to measure and understand ultrashort laser pulses This book contains everything you need to know to measure even the shortest weakest or most complex ultrashort laser pulses Whether you re an undergrad or an advanced researcher you ll find easy to understand descriptions of all the key ideas behind all the FROG techniques all the practical details of pulse measurement and many new directions of research This book is not like any other scientific book It is a lively discussion of the basic concepts It is an advanced treatment of research level issues      **Terahertz Sources and Systems** R.E. Miles,P. Harrison,D. Lippens,2012-12-06 Terahertz technology has moved on from being a useful but expensive circuit technique applied largely in astronomy and space science to become a subject in its own right with important applications terahertz imaging in particular Indeed the driving force in terahertz technology is currently imaging and spectroscopy We now have the means to obtain images and chemical information in this frequency band The images reproduced in this volume are striking and not surprisingly the clinical and analytical uses are the subject of intense activity There is still however no complete range of active THz electronic components but an encouraging conclusion of the book is that THz electronics will become necessary in communications systems in the foreseeable future Terahertz technology has come of age and the future lies open to new exciting science and vital applications      *Optical Microcavities* Kerry Vahala,2004 Optical microcavities are structures that enable confinement of light to microscale volumes The universal importance of these structures has made them

indispensable to a wide range of fields This important book describes the many applications and the related physics providing both a review and a tutorial of key subjects by leading researchers from each field Physics and Simulation of Optoelectronic Devices VI Peter Blood, 1998 **VCSELs** Rainer Michalzik, 2012-10-16 The huge progress which has been achieved in the field is covered here in the first comprehensive monograph on vertical cavity surface emitting lasers VCSELs since eight years Apart from chapters reviewing the research field and the laser fundamentals there are comprehensive updates on red and blue emitting VCSELs telecommunication VCSELs optical transceivers and parallel optical links for computer interconnects Entirely new contributions are made to the fields of vectorial three dimensional optical modeling single mode VCSELs polarization control polarization dynamics very high speed design high power emission use of high contrast gratings GaInNAsSb long wavelength VCSELs optical video links VCSELs for optical mice and sensing as well as VCSEL based laser printing The book appeals to researchers optical engineers and graduate students *Handbook of Optics, Third Edition Volume IV: Optical Properties of Materials, Nonlinear Optics, Quantum Optics (set)* Michael Bass, Casimer DeCusatis, Jay M. Enoch, Vasudevan Lakshminarayanan, Guifang Li, Carolyn MacDonald, Virendra N. Mahajan, Eric Van Stryland, 2009-10-06 The most comprehensive and up to date optics resource available Prepared under the auspices of the Optical Society of America the five carefully architected and cross referenced volumes of the Handbook of Optics Third Edition contain everything a student scientist or engineer requires to actively work in the field From the design of complex optical systems to world class research and development methods this definitive publication provides unparalleled access to the fundamentals of the discipline and its greatest minds Individual chapters are written by the world's most renowned experts who explain illustrate and solve the entire field of optics Each volume contains a complete chapter listing for the entire Handbook extensive chapter glossaries and a wealth of references This pioneering work offers unprecedented coverage of optics data techniques and applications Volume IV covers optical properties of materials nonlinear optics and quantum optics **American Book Publishing Record** , 2000-07 **Handbook of Optics, Volume IV** Optical Society of America, 2000-11-17 A new volume in the field's bestselling optics reference an entirely new opus focusing exclusively on fiber optics Contains an ultra handy comprehensive index to all four Handbook of Optics volumes Fizika tverdogo tela , 2004 *Vertical-cavity Surface-emitting Lasers* , 2000 *Optoelectronics and Spintronics in Smart Thin Films* James Ayodele Oke, Tien-Chien Jen, 2023-12-06 Smart thin films composed of functional materials deposited in thin layers have opened new avenues for the development of flexible lightweight and high performance devices Optoelectronics and Spintronics in Smart Thin Films presents a comprehensive overview of this emerging area and details the current and near future integration of smart thin films in solar cells and memory storage Offers an overview of optoelectronics and spintronics Discusses synthesis of smart nanomaterials Describes deposition techniques and characterization of thin films Considers the integration and application of opto spintronics for technological advancement of solar cells and memory storage devices

Focused on advancing research on this evolving subject this book is aimed at advanced students researchers and engineers in materials chemical mechanical and electrical engineering as well as applied physics Books In Print 2004-2005 Ed Bowker Staff,Staff Bowker, Ed,2004 *The British National Bibliography* Arthur James Wells,2000 *Chemical Abstracts* ,2002 **Heterogeneous Optoelectronics Integration** Elias Towe,2000 Numerous efforts are directed at investigating the use of optics at short distances for example at the chip to chip and board to board levels of the interconnection hierarchy This book provides an overview of the state of the art in heterogeneous integration of electronics optoelectronics and micro optics for short distance optical interconnections **Microoptics** Stefan Sinzinger,Jürgen Jahns,2006-03-06 Microoptics is an important enabling technology for many areas of application In this updated second edition of their modern text and reference book Stefan Sinzinger and J rgen Jahns expertly and comprehensively present the basics and applications in microoptics while incorporating the most important developments in recent years An absolute must for physicists and electrical engineers from advanced students right up to designers working in the field

## Whispering the Secrets of Language: An Psychological Journey through **Semiconductor Quantum Optoelectronics From Quantum Physics To Smart Devices**

In a digitally-driven world wherever displays reign supreme and instant connection drowns out the subtleties of language, the profound secrets and psychological nuances hidden within words usually go unheard. Yet, situated within the pages of **Semiconductor Quantum Optoelectronics From Quantum Physics To Smart Devices** a fascinating fictional treasure sporting with raw emotions, lies an exceptional journey waiting to be undertaken. Penned by a talented wordsmith, this charming opus invites readers on an introspective trip, gently unraveling the veiled truths and profound affect resonating within the cloth of each and every word. Within the psychological depths of the poignant review, we can embark upon a honest exploration of the book is primary subjects, dissect its charming publishing style, and yield to the powerful resonance it evokes deep within the recesses of readers hearts.

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